Technical FAQ

FAS8200

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1 FAS8200 Overview

The FAS82000 is the new midrange NetApp® storage controller. With this new midrange storage controller, NetApp has dramatically enhanced the performance and high-performance I/O density in the same 3U HA footprint. The FAS8200 supports 40GbE and 32Gb FC connections and includes the latest in SAS connectivity, the SAS 3.0 standard with 12Gb speeds. The FAS8200 also continues with the most versatile I/O interface available, the UTA2 connections that support 10GbE and 16Gb FC, and can be easily changed between these two protocols in the field. The FAS8200 also has two 10GbE connectivity options, 10GbE and 10GbE Base-T.

What is the FAS8200 series platform?

Answer: The FAS8200 series is NetApp's next-generation midrange platform.

Are there other FAS8200 models?

Answer: No, the only model is the FAS8200.

What are some of the new features in the FAS8200 family?

Answer:

- The FAS8200 features Broadwell-DE architecture
- Onboard NVMe M.2 flash
- PCIe Gen 3 architecture
- High-speed DDR4-2133 memory
- Onboard 10GbE, 16Gb FC or 10GbE UTA2, 10GbE Base-T, and SAS 3.0 12Gb ports
- External USB port can be used to recover boot media or install ONTAP® image
- Modern micro-USB serial console port runs at 115,200 baud rate

Does the FAS8200 come with protocols included?

Answer: The base software bundle for the FAS8200 includes all protocols.

What are the new FAS8200 model transitions?

Answer:

- The FAS8200 replaces the FAS8020 and FAS8040.

2 FAS8200 Controller and Chassis

Which components make up the FAS8200?

Answer: The FAS8200 components are the controller module, chassis, power supplies, possibly SFP+ modules, and adapters supported in the controller.

What is the rack unit for the FAS8200 components?

Answer: The FAS8200 chassis is 3U high.

What are the FAS8200 model numbers?

Answer: The FAS8200 is the new midrange model number.

Which model string extensions denote HA?

Answer:

- The FAS8200 single-controller model string is the FAS8200.
- The FAS8200 dual-controller model string is the FAS8200A.

Are the FAS8200 controllers hot swappable?

Answer: The FAS8200 controller is hot swappable and, it is important to note, does not require your turning off either power supply (PSU).

Does the FAS8200 have NVMe Flash Cache included with base configuration?

Answer: Yes, 1TB of NVMe Flash Cache is included per node or 2TB for an HA pair. The NVMe Flash Cache can be increased to 2TB per node or 4TB for an HA pair.

3 FAS8200 HA and Standalone Configurations

Which standalone and HA configurations are supported on the FAS8200?

Answer: Table 1 lists the configurations supported on the FAS8200.

Table 1) Supported FAS8200 configurations.

Configuration	Supported
Single-chassis controller with blank	Yes, with MetroCluster™ only
Single-chassis HA dual controllers	Yes

What is the naming convention for the FAS8200 configurations?

Answer: The FAS8200 is known as a single-chassis configuration. The FAS8200A is a single-chassis HA configuration.

Are dual-chassis HA configurations possible on the FAS8200 series?

Answer: No, the FAS8200 cannot span its chassis unless MetroCluster is used.

Is MetroCluster available on the FAS8200 series?

Answer: Yes. MetroCluster software is available on the FAS8200 series. FC-VI connections used in MetroCluster deployments can take advantage of the onboard UTA2 ports, eliminating the need to consume a slot with an adapter.

What is the rack unit for FAS8200 configurations?

Answer: FAS8200 chassis are 3U each.

Which field upgrades are available with the FAS8200?

Answer: All FAS8200 standalone controllers can have a second controller of the same model added to become HA.

Does hardware-assisted takeover work on the FAS8200?

Answer: Yes. Hardware-assisted takeover on the FAS8200 uses the service processor (SP), and the hardware-assisted takeover functionality is similar to that of the SP in the FAS2200, FAS2500, and FAS8000 controller families. There is more information about the SP in section 4.

Are there any single points of failure in the FAS8200?

Answer: Although the chassis backplane is not fault tolerant, there are no active components on the backplane on which controllers rely to remain in a running state. This passive backplane is a highly reliable component that is very unlikely to cause an outage on a FAS8200 series system. Reliable passive backplanes are used in almost all modular storage systems with two controllers in a single chassis as well as network switches. Also, NetApp has been shipping systems and subsystems with shared backplanes for quite some time (DS14-class disk shelves, the FAS200 series, FAS2000, FAS3100, FAS/V3200, and some FAS/V6200 and FAS8000 models) that demonstrate very high reliability of the chassis backplane.

Does the FAS8200 series support FlexArray?

Answer: Yes, the FAS8200 supports a la carte software licensing to virtualize storage arrays with FlexArray®.

Does the FAS8200 support SnapLock?

Answer: SnapLock® software is supported in ONTAP 9 and later and can be used on the FAS8200 at release as an a la carte licensing option.

Where is the upgrade procedure to replace existing controllers with FAS8200?

Answer: Here is a link to the Controller Upgrade Express Guide.

4 FAS8200 System Features

How many nodes can a FAS8200 cluster have?

Answer: The FAS8200 can have up to 24 nodes with NAS and up to 12 nodes with SAN.

Does the FAS8200 have onboard flash?

Answer: Yes, the FAS8200 features onboard NVMe M.2 flash, which provides functionality similar to that provided by Flash Cache™ data caching.

How much onboard flash does the FAS8200 have?

Answer: The FAS8200 has 1TiB of flash per node and 2TiB for an HA pair.

Can the FAS8200 have additional onboard flash added?

Answer: Yes, the FAS8200 can have an additional 1TiB NVMe module of flash added per node.

How much memory and NVMEM does the FAS8200 have?

Answer: Table 2 shows system memory.

Table 2) System memory for HA configurations.

HA Pairs	Physical Memory	Total NVMEM
FAS8200A	256GB	32GB

Does the FAS8200 use all of the memory and NVMEM?

Answer: Yes. All FAS8200 models fully utilize the available memory and NVMEM at launch.

Which type of processors and how many processing cores does the FAS8200 have?

Answer: Table 3 gives processing core information.

Table 3) Processing cores for HA configurations.

HA Pairs	Architecture	Processors	Processing Cores	Processor Speed	Processor Model
FAS8200A	Broadwell-DE	2 x 64-bit 16 core	32	1.7GHz	D-1587

Which ONTAP release is required for the FAS8200?

Answer: The FAS8200 is supported starting in the ONTAP 9.1 RC1 release.

Which ONTAP build does the FAS8200 use?

Answer: The FAS8200 uses the x86_64 build. This same build supports both AMD and the latest platforms based on Intel.

Does the FAS8200 destage NVMEM contents to flash?

Answer: Yes, in the event of unexpected loss of power, the FAS8200 destages NVMEM contents to flash for a permanent, persistent write log of data not committed to disk when power was lost.

Does the FAS8200 encrypt NVLOG data before destaging NVMEM contents to flash?

Answer: Yes, all data in NVMEM is encrypted prior to being stored in flash.

What is the persistent write log feature on the FAS8200 NVMEM?

Answer: The persistent write log feature on the FAS8200 destages NVMEM contents to flash memory in the event of an unexpected loss of power. Because the NVLOG contents are stored in flash memory, they are protected permanently regardless of how long the power outage lasts. During initial bootup after power is restored, the destaged NVLOG is replayed, enabling the file system contents to include any acknowledged writes since the last consistency checkpoint (CP) to disk.

How does the FAS8200 use its NVMEM battery?

Answer: In the event of a dirty shutdown, NVMEM uses its battery to keep the NVLOG DIMMs refreshed during the reboot process. In this event the NVMEM contents are not destaged to flash. In the event of unexpected loss of power, the NVMEM battery keeps the motherboard powered up while the contents of NVMEM are destaged to flash.

How many destages does the NVMEM battery support?

Answer: A fully charged NVMEM battery can handle about 25 destage events.

How long does it take for the FAS8200 NVMEM battery to charge?

Answer: Given the new NVMEM architecture in which the entire motherboard is kept powered during the destage process, significant battery charge is consumed for a destage event. However, because a fully charged battery provides enough power for about 25 destage events, and the battery isn't used to keep the NVMEM contents refreshed for 72 hours, ONTAP should boot up normally after a destage with no pause to charge the battery.

Where are the NVRAM battery material safety data sheets (MSDS)?

Answer: Here are links to the Lithium Ion MSDS on the Field Portal:

LG Lithium Ion MSDS

Sony Lithium Ion MSDS

How does NetApp design their NVMEM batteries to avoid potential lithium-ion fires?

Answer: Here are some of the design considertations for NetApp NVMEM lithium-ion batteries and why NetApp has not had fire issues.

- NetApp does not use any rapid charge modes and does not allow the battery to be charged to an excessively high voltage.
- When the battery is charged to the correct voltage level, the charger is turned off until it requires a recharge.
- When the battery is in use, it is not in a high current discharge mode.
- The battery has protection circuitry that prevents high discharge currents.

What is the NVMEM interconnect in FAS8200 series HA configurations?

Answer: Instead of an Infiniband interface, the FAS8200 NVMEM uses nontransparent bridging (NTB) for the HA interconnect over the backplane. The NVMEM driver functionality works the same as in earlier platforms and handles the RDMA activity to keep NVMEM synchronized between the HA controllers.

Does the FAS8200 have an LCD display?

Answer: No. The FAS8200 does not have an LCD display. However, LEDs are provided on the chassis front to help determine the state of the controller. Remote management has proven to be the primary source for monitoring system information versus LCDs. Also, with the SP, the state of LEDs can be determined remotely.

Can I make an LED blink on the FAS8200 to identify it in a data center?

Answer: From the SP you can use the command `sp identify led 60` to have the fault LED on the controller rear blink for 60 seconds or toggle it on or off with `sp identify led on` and `sp identify led off`.

Does the FAS8200 series support remote management?

Answer: The FAS8200 uses the service processor (SP) used on FAS2200, FAS2500, and FAS8000 systems. The SP has all the features of RLM and BMC along with new ones that improve RASM capabilities. The new features are covered in the next few questions.

What are some of the service processor management features?

Answer: The SP performs field-replaceable unit (FRU) reporting and tracking, monitors and reports on internal sensors, reports on and can set LED states, and actively manages fan speed.

Besides the Ethernet management port interface (the external management port is shared by SP and e0M), the SP can also be accessed from the serial console by toggling with Ctrl-G. Use Ctrl-D to get back to the serial console.

Is the SP connected to both the Ethernet and the serial console?

Answer: The SP is always connected to the Ethernet and the serial console and can be accessed from either. If the SP is accessed over the Ethernet, you can toggle to the serial console with Ctrl-D. If logged in to the serial console, you can toggle in to the SP using Ctrl-G. To get back to the serial console, toggle with Ctrl-D.

Is the SP an FRU like the RLM?

Answer: No. The SP is integrated on the motherboard but runs its own kernel outside ONTAP and is always available.

What are the recommended SP firmware levels?

Answer: Table 4 lists the SP firmware levels, which depend on the ONTAP release used.

Table 4) Recommended SP firmware levels by ONTAP release.

ONTAP Release	SP Firmware Level
ONTAP 9.1 RC1	5.0

What are the recommended BIOS levels on the FAS8200?

Answer: Table 5 lists the BIOS levels, which depend on the ONTAP release used.

Table 5) Recommended BIOS levels by ONTAP release.

ONTAP Release	BIOS Level
ONTAP 9.1 RC1	11.0

There is no NMI button on the FAS8200. How do I generate a core?

Answer: The SP is required to generate a core file. After you are logged in to the SP, run the command system core.

What are the system diagnostics in the FAS8200?

Answer: The FAS8200 uses system-level diagnostics, or SLDIAG, in place of the older SYSDIAG on most platforms. SLDIAG is accessed using maintenance mode during bootup. If sysdiag is entered at the loader prompt, the system boots into maintenance mode.

What is the boot medium in the FAS8200?

Answer: The FAS8200 uses an mSATA USB flash in place of CompactFlash.

Is NetApp Volume Encryption supported on FAS8200?

Answer: Yes, NetApp Volume Encryption is supported on FAS8200.

Are FlexGroups supported on FAS9000?

Answer: Yes, FlexGroups are supported on FAS9000

Does the FAS9000 have Trusted Platform Module (TPM) on the motherboard?

Answer: Yes, the FAS9000 does have the TPM onboard on the motherboard.

Does ONTAP or onboard key manager (OKM) use the TPM?

Answer: No, not at this time.

5 FAS8200 I/O

What are the recommended and supported cluster interconnect ports for ONTAP 9.1 on the FAS8200?

Answer: Refer to Table 6 for cluster interconnect port requirements and recommendations.

Table 6) Onboard I/O ports on FAS8200.

Recommended	Supported / TNSC Only
e0a, e0b (10GbE ports)	e0c, e0d (10GbE Base-T ports)[1] e0e, e0f, e0g, e0h (UTA2 ports) [1]

1) Supported as cluster interconnects with two node switchless clusters (TNSC).

What ports can be used for FC-VI connections with MetroCluster on the FAS8200?

Answer: Refer to Table 7 for cluster interconnect port requirements and recommendations.

Table 7) MetroCluster FC-VI port options.

Recommended	Supported
0e, 0f (UTA2 ports)	0g, 0h (UTA2 ports) FC-VI adapter

What is the command to set UTA2 ports to FC-VI?

`Answer:` The command to use is: `system node hardware unified-connect modify -node coiw-dev-02 -adapter 0h -mode fc -type fcvi.`

How can you determine cluster interconnect traffic?

Answer: Use the command `statistics lif show` to determine the amount of traffic on the cluster interconnects. If you set an interval it'll spit out how much has been received/sent during that time.

What are the onboard FAS8200 ports?

Answer: Refer to Table 8 for cluster interconnect port requirements and recommendations.

Table 8) Onboard I/O ports on FAS8200.

Port Type/Number per PCM	Label	Host Protocols
Mini-SAS3 (4)	0a, 0b, 0c, 0d	N/A
10GbE (2)	e0a, e0b	NFS, CIFS, iSCSI
10GbE Base-T	e0c, e0d	NFS, CIFS, iSCSI
UTA2 (4)	e0e/0e, e0f/0f, e0g/0g, e0h/0h	4/8/16Gb FC SFP: FC 10GbE SFP: FCoE, NFS, CIFS, iSCSI GbE SFP: NFS, CIFS, iSCSI
GbE e0M/SP	Wrench	N/A
Serial console (micro-USB)	IOIOI	N/A
Serial console (RJ45)	IOIOI	N/A
USB 2.0		N/A

How many slots does the FAS8200 have?

Answer: The FAS8200 has two PCIe Gen3 slots per node and four slots in an HA pair.

Which PCIe architecture does the FAS8200 use?

Answer: The FAS8200 uses the PCIe Gen 3 architecture for motherboard connectivity to onboard ports and slots.

Can the FAS8200 32Gb adapter ports be set to initiator?

Answer: No, the 32Gb FC ports only support target mode.

Do the 32Gb FC ports autorange?

Answer: Yes, the 32Gb FC ports can autorange down to 8Gb and 16Gb speeds.

What ONTAP release is the 40GbE adapter supported in on FAS8200?

Answer: Support for the 40GbE adapter is targeted for ONTAP 9.1 RC2.

What is the bandwidth for the dual-port 40GbE adapter?

Answer: The total bandwidth of the two 40GbE ports is around 55Gbps.

Can the 40GbE adapter be used for cluster interconnects on the FAS8200?

Answer: No, only the onboard 10GbE, 10GbE Base-T, or UTA2 ports set to 10GbE can be used for cluster interconnects on the FAS8200.

Can the 40GbE ports be broken down into separate 10GbE ports?

Answer: Yes, one 40GbE port per adapter can be broken down into four separate 10GbE ports. In this case each of the 10GbE ports has a unique port name, depending into which port the fan out cable is plugged. When breaking a 40GbE port into four 10GbE ports, the ASIC automatically disables the second 40GbE port.

What are the port names when breaking 40GbE ports into 10GbE ports?

Answer: In this case each of the 10GbE ports has a unique port name, depending into which port the fan out cable is plugged. The 'a' 40GbE port results in 10GbE port names 'a,' 'b,' 'c,' and 'd.' The 'b' 40GbE port results in 10GbE port names 'e,' 'f,' 'g,' and 'h.' Note that you cannot use both 40GbE ports to fan out to 10GbE ports.

What are Unified Target Adapter 2 ports?

Answer: Unified Target Adapter 2 (UTA2) ports can be configured as 16Gb FC, 10GbE, or GbE. In the case of 10GbE, the UTA2 ports support FCoE, iSCSI, NFS, and CIFS; with GbE, the UTA2 ports support NFS, CIFS, and iSCSI. The previous generation of UTA ports supported only the 10GbE personality. With the addition of FC capabilities, UTA2 becomes the second generation of NetApp UTA ports.

Does the FAS8200 have onboard UTA2 ports?

Answer: Yes. The FAS8200 has four onboard UTA2 ports.

What are the configuration rules for UTA2 ports?

Answer: UTA2 ports are based on dual-port ASICs, and both ports have to be set to either 16Gb FC or 10GbE. Both ports on the X1143A-R6 share the same ASIC and have to be set to the same type: 10GbE or 16Gb FC.

When UTA2 ports are set to the FC personality, individual ports on the ASIC can be set to either target or initiator mode.

What are the UTA2 port pairs?

Answer: UTA2 port pairs on the FAS2620 are e0c/0c and e0d/0d. Port pairs on the FAS8200, FAS8060, and FAS8080 EX are first pair e0e/e0 and e0f/0f and second pair e0g/0g and e0h/0h. Both ports on the X1143A-R6 are considered port pairs, and additional X1143A-R6 adapters in other slots are their own port pair.

Can UTA2 ports be set to the 16Gb FC or 10GbE personality in the field?

Answer: Yes. The UTA2 port personality can be changed in the field using the `ucadmin` command.

See the FAS8200 SE presentation for more details about configuring UTA2 ports in the field, including using the ucadmin command.

Can UTA2 ports set to the 10GbE personality be mixed with 10GbE ports in a VIF?

Answer: Yes. Both ports can be mixed in the same 10GbE VIF.

What causes frame length errors on UTA2 ports in tagged VLANs?

Answer: This is an issue in the UTA2 ASIC and only affects CGMP, STP, DDP, and SNA protocols. Other more common UTA2 protocols such as NFS, CIFS, iSCSI, and FCoE use Ethernet II frame formatting and are not affected by this issue.

What are the supported SFP+ and copper cables with onboard and adapter-based UTA2 ports?

Answer: See Table 9 for supported UTA2 connectivity options.

Table 9) Supported UTA2 connectivity options.

	Onboard UTA2 Ports		
	16Gb FC	10GbE	1GbE
SFP+	X6596-R6	X6599A-R6	X6567-R6 (optical) X6568-R6 (RJ-45)
Cables	See Hardware Universe (HWU)		

Which protocols are supported on UTA2 ports?

Answer: The onboard and adapter-based UTA2 ports support FC and, when set to the 10GbE personality, FCoE, iSCSI, NFS, and CIFS.

The GbE SFP transceivers support NFS, CIFS, and iCSCI.

Can the UTA2 port personalities be set from maintenance mode?

Answer: Yes. You can set the port personalities in maintenance mode.

Can the UTA2 ports be used for cluster interconnects with ONTAP on the FAS8200?

Answer: Yes. The UTA2 ports are supported for cluster interconnects.

Are UTA2 ports configured when ordering the FAS8200?

Answer: Yes. When quoting FAS8200 systems, you are asked for onboard and adapter-based UTA2 port personality and, in the case of Ethernet, if you need SFP+ or twinax copper cables. Manufacturing then sets the port personality and inserts the correct SFP+.

Can UTA2 ports be used in target or initiator mode when set to the FC personality?

Answer: Yes. Onboard and adapter-based UTA2 ports can be configured as target or initiator.

Do the UTA2 ports autorange?

Answer: UTA2 ports set to FC personality ports autorange across 16/8/4Gbps speeds but do not work with 1Gb or 2Gb FC speeds. UTA2 ports set to the 10GbE personality do not autorange down to GbE speeds but do support GbE speeds with the SFPs shown in Table 9.

Do the onboard UTA2 ports provide fault tolerance?

Answer: The FAS8200 has two UTA2 ASICs. Port pairs are e0c/0c and e0d/0d and share an ASIC, and port pairs e0e/0e and e0f/0f share the second ASIC.

Are long-reach (LR) connections supported for the onboard UTA2 ports?

Answer: Yes, an SFP+ is available for LR on the FAS8200. The part number is X65403, and the description is CONN, SFP, 16Gb, FC, LR, 10km.

Can UTA2 ports in the FC personality be used with tape devices?

Answer: Direct connection to tape drives with UTA2 ports is supported on HP, Quantum, and Tandberg tape devices. IBM tape devices requires an FC switch between the UTA2 port and tape drive.

Do the onboard 10GbE ports support FC over Ethernet (FCoE)?

Answer: No. Onboard 10GbE ports do not work for FCoE uses.

Do the onboard 10GbE ports on the FAS8200 use an ASIC?

Answer: No, the onboard 10GbE ports connect to interfaces on the Broadwell-DE processor.

Do the onboard FAS8200 10GbE ports autorange down to GbE?

Answer: No. The onboard 10GbE ports do not autorange but can be set to GbE speed by using the SFP options shown in Table 9.

Can I use 1GbE and 10GbE on the same port pair?

Answer: Yes, when the port pair is set to Ethernet, you can use 1GbE and 10GbE connections on the same UTA2 ASIC.

Do the onboard FAS8200 10GbE Base-T ports autorange down to GbE?

Answer: Yes, the onboard 10GbE Base-T ports can autorange to GbE independently from each other

Do ports on the 10GbE BaseT ports on X91120A autorange to GbE independent from each other?

Answer: Yes, ports on the X91120A autorange between 10GbE and GbE speeds independent from each other.

What are the supported cables for onboard 10GbE for onboard FAS8200 ports?

Answer: For the latest about supported FAS8200 cables, refer to the Hardware Universe (HWU).

What are the mode and reach for the onboard 10GbE and UTA2 ports?

Answer: The onboard GbE and 10GbE ports are short-reach multimode ports.

Which management interfaces does the FAS8200 have?

Answer: See Table 10 for FAS8200 management interfaces.

Table 10) Onboard management interfaces.

Active-Active	Micro-USB Serial Console	RJ-45 Serial Console	Management SP/e0M (Wrench)
All models	2		2 x GbE (e0M) 2 x 10/100Mb SP[1]

[1] The SP port links to the external switch at GbE speed, but the internal path is limited to 10/100Mb.

Do the e0M and SP ports support IPv6?

Answer: Yes. Both e0M and SP support IPv6.

Is the external USB 2.0 port supported?

Answer: Yes, the external USB port can be used to boot ONTAP if the onboard boot media has failed, to install a particular release of ONTAP, or install a firmware service image. The external USB port is only enabled during these activities, and its activation is based on specific commands.

What is the USB device formatted for use with the FAS8200?

Answer: The USB device needs to have FAT32 formatting to use on the external USB port.

What are the allowed use cases with the FAS8200 external USB port?

Answer: Table 11 shows use cases in which the external USB port can be used.

Table 11) External USB port use case scenarios.

Scenario	Prerequisites	Command
Perform boot device recovery from loader prompt	• USB 2.0 device formatted to FAT32 with correct ONTAP netboot.tgz and image.tgz image • Not hot pluggable, need to boot to loader prompt after USB device is inserted into external USB port	• boot_recovery using the netboot image at the loader prompt • Select appropriate ONTAP image at the boot menu
Fetch ONTAP software for installation	USB 2.0 device formatted to FAT32 with correct ONTAP image	• system node image update/get • Command has an additional option to fetch ONTAP from USB device
Fetch service image for firmware update	USB 2.0 device formatted to FAT32 with correct service image	• system node firmware download • Command has an additional option to fetch ONTAP from USB device

At what speed does the FAS8200 serial console port run?

Answer: The FAS8200 serial console ports run at 115K baud rate.

6 FAS8200 Storage

Is Advanced Drive Partitioning (ADP) supported on the FAS8200?

Answer: Yes, starting in ONTAP 9.2 up to 24 drives can be partitioned to improve storage efficiency.

What approach is used by ADP to partition drives on the FAS8200?

Answer: ADP on FAS8200 creates a root and a data partition. By default the configuration results in nine root and data partitions per node, two root and data parity partitions per node, and a spare root and data partition per node (9d + 2p + 1s).

What SAS adapters are supported in the FAS8200?

Answer: The only supported SAS adapter in the FAS8200 is the X2069-R6.

Why is the X2065-R6 SAS adapter not supported in the FAS8200?

Answer: With the onboard 12Gb SAS ports, system health monitors are degraded by having the old X2065 SAS HBA in the FAS8200. The reason is the old 6Gb SAS ASIC on the X2065 and the new 12Gb SAS ASIC onboard the FAS8200 identify devices differently. The X2069-R6 is supported in FAS8200 and supports 6Gb SAS speeds that can be used with DS2246, DS4246, and DS4486 shelves.

How many shelves are configured with each FAS8200 node?

Answer: FAS8200 systems are configured in the factory with only one shelf per node (node + 1 shelf). Additional shelves are not configured and arrive having shelf IDs set to ‘0’ and no disk ownership assigned.

What happens if the shelf IDs are not set and disk ownership is not assigned?

Answer: If there are conflicting shelf IDs, ONTAP assigns a soft shelf ID based on the shelf serial number. If the case concerns disk ownership, provided there are disks on the stack with ownership already set, ONTAP automatically handles assigning the remaining unowned disks. Because one shelf per node has disk ownership set, orders with one stack per node should not need disk ownership assignment.

What are the maximum spindle counts and capacities supported on the FAS8200 series?

Answer: Table 12 shows maximum spindle counts and capacities.

Table 12) Maximum spindle counts and capacities.

Standalone and HA	Maximum Spindles SAS/SATA	Maximum SSDs	Maximum SSD + SAS and/or SATA
FAS8200	480	480	480

What are the supported flash limits on the FAS8200?

Answer: Table 13 shows these limits.

Table 13) Flash limits on the FAS8200 in ONTAP.

	Flash Limits
NVMe M.2 onboard Flash Cache	Default 1TB per node Maximum 2TB per node
Maximum onboard flash + Flash Pool™ cache (HA and standalone)	72TiB

What are the maximum aggregate and volume sizes on the FAS8200 series?

Answer: Table 14 shows the maximum aggregate and volume sizes.

Table 14) Maximum aggregate and volume sizes.

	FAS8200
Maximum number of volumes	1,000
Maximum aggregate size	400TB
Maximum volume size	100TB
Minimum root volume size	350GB

What is the maximum number of volumes on the FAS8200?

Answer: The FAS8200 supports up to 1,000 volumes.

Which shelves and shelf modules are supported on the FAS8200 series?

Answer: Table 15 shows the supported shelves and shelf modules.

Table 15) Supported shelves and shelf modules.

Shelf	Shelf Module
DS224C (quotable)	IOM12
DS212C (quotable)	IOM12
DS2246 (migrated shelf)	IOM6 IOM12
DS4246 (quotable)	IOM6 IOM12
DS4486 (quotable)	IOM6
DS460C	IOM12

Which hard disk drives (HDDs) are supported in the FAS8200?

Answer: Any disk supported in the shelves listed in Table 12 in ONTAP 9.x is supported on the FAS8200 series. For the latest about supported drive options on the FAS8200, see the Hardware Universe (HWU).

Are all-SSD configurations supported on the FAS8200?

Answer: Yes, all-SSD configurations are supported on the FAS8200.

What is the maximum shelf depth for stacks with SSDs?

Answer: The maximum shelf depth for stacks containing SSDs is four. This applies to pure SSD stacks and Flash Pool stacks with SSD and HDD disks.

Does the FAS8200 use ACP cabling for out-of-band management?

Answer: No, there is no locked wrench port on the FAS8200 for traditional ACP cabling.

How is SAS storage management handled on the FAS8200?

Answer: Starting in ONTAP 9, SAS storage management is handled in band over the SAS cables.

Is there a demo video on how RAID-TEC works?

Answer: Yes, here is a link to the YouTube video that can be shared with customers:

RAID-TEC Demonstration

7 FAS8200 Chassis Power Supplies, Weight, and Thermals

What are the FAS8200 chassis dimensions?

Answer: For the most comprehensive information about FAS8200 dimensions and weights across various configuration options, refer to the Hardware Universe (HWU).

Table 16) FAS8200 chassis dimensions.

Dimension	Metric	English
Height	3U	
Height (measured)	13cm	5”
Width	44.7cm	17.6” (fits 19” rack)
Chassis depth	60.8cm	23.9”
With cable management	73.5cm	28.9”

What are the FAS8200 environmentals?

Answer: For the most comprehensive information about FAS8200 environmental details, refer to the Hardware Universe (HWU).

Table 17) FAS8200 environmentals.

	Operational	Storage	Transit
Temperature Range	From 41°F up to 113°F (5°C up to 45°C)	From -40°F up to 158°F (-40°C up to 70°C)	From -40°F up to 158°F (-40°C up to 70°C)
Relative Humidity	From 8% up to 90%	From 10% up to 95%	From 10% up to 95%
Altitude	Up to 9999ft (3048m)	Up to 39999ft (12192m)	Up to 39999ft (12192m)

What are the FAS8200 weights?

Answer: For the most comprehensive information about FAS8200 weight information across various configuration options, refer to the Hardware Universe (HWU).

The FAS8200 standalone is 67.46 pounds (30.6kg), and the HA is 78.92 pounds (35.8kg).

What are the wattage and BTU ratings for the standalone FAS8200?

Answer: For the most comprehensive information about FAS8200 wattage and BTU ratings across various configuration options, refer to the Hardware Universe (HWU).

Table 18) Standalone FAS8200 watts and BTU ratings.

	110V		220V	
	Worst Case	Typical	Worst Case	Typical
Amps (A)	4	3.15	1.97	1.55
Watts (W)	392	308	385	302
BTU	1,338	1,052	1,314	1,031

What are the wattage and BTU ratings for FAS8200 HA pairs?

Answer: For the most comprehensive information about FAS8200 wattage and BTU ratings across various configuration options, refer to the Hardware Universe (HWU).

Table 19) FAS8200 HA watts and BTU ratings.

	110V		220V	
	Worst Case	Typical	Worst Case	Typical
Amps (A)	6.49	5.65	3.19	2.77
Watts (W)	636	553	624	542
BTU	2,171	1,888	2,130	1,850

Does the FAS8200 support both 110V and 220V power?

Answer: Yes. Both voltage levels are supported on the FAS8200.

Are the FAS8200 power supplies assigned to a particular controller?

Answer: No. The two power supplies are assigned to the FAS8200 chassis.

What is the Energy Star rating for FAS9000?

Answer: Previously we designed to 80+ Gold but our older storage shelves and integrated entry level systems came in at 80+ Silver. With our new hardware released late last year we designed to and tested against 80+ Platinum standards. However, while we design and test to these standards we haven't gone through the formal certification.

8 Configuration Details: Supported Adapters

For the latest information about FAS8200 FRUs, refer to the Hardware Universe (HWU).

Adapter Cards

Adapters are shown in top to bottom priority for load order, slot priority is 1, 2

Card Category	Description	Marketing PN	Mfg PN
MetroCluster	2p 16Gb FC-VI SFP+	X1928A-R6	111-00941
Networking (high performance)	2p 10GbE NIC Cu/Op	X1117A-R6	111-00754
			111-01232
	NIC, 2x40GbE, QSFP	X1144A	111-03380
	2p 16Gb/10Gb UTA2 Cu/Op	X1143A-R6	111-00910
	2p 10Gb NIC Cu	X1120A-R6	111-01688
Block access (high performance)	2-Port FCP Target 32Gb PCIe w/SFP+	X1134A	111-03249
	2p 16Gb/10Gb UTA2 Cu/Op	X1143A-R6	111-00910
	4p 16Gb FC SFP+	X1133A-R6	111-02451
	4p 8Gb FC Op	X1132A-R6	111-00481
Performance acceleration	NVME, FLASH, 512GB	X3310A	111-03065
	NVME, FLASH, 1TB	X3311A	111-03066
Storage	2p 16Gb/10Gb UTA2 Cu/Op	X1143A-R6	111-00910
	4p 12Gb SAS Cu	X2069-R6	111-02026
	4p 16Gb FC SFP+	X1133A-R6	111-02451
	4p 8Gb FC Op	X1132A-R6	111-00481
	4p 4Gb FC Op	X2054A-R6	111-00285
Block access	4p 4Gb FC Op	X1130A-R6	111-00416
Networking	4p 1GbE NIC Cu	X1049C-R6	111-01034
	4p 1GbE NIC Op	X1048A-R6	111-00909
Tape	2p 16Gb/10Gb UTA2 Cu/Op	X1143A-R6	111-00910
	4p 16Gb FC SFP+	X1133A-R6	111-02451
	4p 8Gb FC Op	X1132A-R6	111-00481
	4p 12Gb SAS Cu	X2069-R6	111-02026
	4p 4Gb FC Op	X2054A-R6	111-00285

9 Configuration Details: FRUs

For the latest information about FAS8200 FRUs, refer to the Hardware Universe (HWU).

Field Replaceable Units

FRU Unit Type	Marketing PN	Description
Battery	X1847-R6	Lithium System Battery CR2032, R6
	X3150A	R7, NV, BATT, 4CELL, HiAh, HOLDER
Cable management guide	X3321A	SUB ASSY, SM, BKT, CBL MGMNT SET
Chassis	X3160A	R7, CHAS ASSY, W/ MIDPLANE/FAN/PSU
Controller blank	X3118-R6	Blanking Panel, SYS CNTR
Fan	X8535-R6	Fan Assembly, FAS/V32X0, SA320, FAS8020
Memory module	X3223A	RDIMM, 32GB, ECC, FAS8200, A300
	X3311A	Flash Cache, 1TB, -C
mSATA	X3320A	R7, DRIVE, SSD, 128GB, mSATA
Processor controller module (PCM)	X3171A	SUB ASSY, CONTROLLER, MEM
	X3172A	R7, SUB ASSY, CONTROLLER, NO MEM
PSU	PH-FAS800__PSU	PH-FAS8200 - PWR SPLY, 1300W, AC, PLATINUM, FAS8200
Rail kit	X5515A-R6	Kit, 2-Post (Round) or 4-Post (Square), 24"-32" Rail
	X5525A-R6	Kit, 2-Post, Round-Hole
	X5526A-R6	Kit, 4-Post, Square-Hole, 24"-32" Rail
	X5529A-R6	Kit, 4-Post, Swift, Square-Hole, 24"-32" Rail
	X877B-R6	Rail Kit II, NetApp Cabinet, R6
	X8783A-R6	Rail Kit III, NetApp Cabinet, R6
Transceiver	X65400A-R6	XCVR, QSFP, MPO, Optical, 6Gb, SAS (SAS 6Gb)
	X65402	Conn, QSFP, 40GbE SR, for NetApp controller cluster (Ethernet 40Gb)
	X65403	CONN, SFP, 16Gb FC, LR, 10km (FC-VI, Fibre Channel 16Gb, Fibre Channel 4/8/16Gb)
	X6567-R6	SFP Optical 1GB Shortwave Multimode (Ethernet 1/10Gb, Fibre Channel 4/8/16Gb)
	X6568-R6	SFP Copper 1GB RJ-45 (Ethernet 1/10Gb, Fibre Channel 4/8/16Gb)
	X6569-R6	XCVR, SFP+, Optical, 10GbE, Shortwave, X1117A (Ethernet 10Gb)
	X6589-R6	XCVR, SFP+, Optical, 10GbE, Shortwave (Ethernet 1/10Gb, Fibre Channel 4/8/16Gb)
	X6596-R6	XCVR, SFP+, Optical, 16Gb, FC, Shortwave (Ethernet 1/10Gb, Fibre Channel 16Gb, Fibre Channel 4/8/16Gb, Fibre Channel 4Gb, Fibre Channel 8Gb)
	X6599A-R6	XCVR, SFP+, Optical, 10GbE, Shortwave (Ethernet 1/10Gb, Ethernet 10Gb, Fibre Channel 4/8/16Gb)
	X6600A-R6	XCVR, SFP+, Optical, 10GbE, Shortwave, X1143A (Ethernet 10Gb)
	X6601A-R6	XCVR, SFP+, Optical, 16Gb, FC, Longwave (Ethernet 1/10Gb, FC-VI, Fibre Channel 16Gb, Fibre Channel 4/8/16Gb)
	X6602A-R6	XCVR, SFP+, Optical, 16Gb, FC, Shortwave (Fibre Channel 16Gb, Fibre Channel 4Gb, Fibre Channel 8Gb)
	X6603A	SFP+ Optical, 32Gb FC Shortwave (Fibre Channel 8/16/32)

10 Sysconfig Output

```
FAS8200-230-51-52::> run local version
NetApp Release 9.1: Tue Aug  2 15:23:08 IST 2016   <1d>

FAS8200-230-51-52::> run local sysconfig -av
        NetApp Release 9.1: Tue Aug  2 15:23:08 IST 2016
        System ID: 0537002848 (FAS8200-230-51); partner ID: 0537002860 (FAS8200-230-52)
        System Serial Number: 941621000062 (FAS8200-230-51)
        System Rev: 81
        System Storage Configuration: Multi-Path HA
        System ACP Connectivity: Inband Active
        All-Flash Optimized: false
        Backplane Part Number: 111-02495
        Backplane Rev: 81
        Backplane Serial Number: 021617008455
        slot 0: System Board 1.7 GHz (System Board XXII 81)
                Model Name:         FAS8200
                Part Number:        111-02493
                Revision:           81
                Serial Number:      021620006566
                BIOS version:       11.0X14
                Loader version:     6.0X22
                Processors:         16
                Processor type:     Intel(R) Xeon(R) CPU D-1587 @ 1.70GHz
                Memory Size:        131072 MB
                Memory Attributes:  Bank Interleaving
                                    Hoisting
                                    Rank Interleaving
                                    Channel Interleaving
                                    Chipkill ECC
                NVMEM Size:         8190 MB of Main Memory Used
                Controller:         A
                PCIE Switch 0:      id 0 519 1.04
                PCIE Switch 1:      id 1 519 1.08
        Service Processor           Status: Online
                Firmware Version:   5.0X23
                Mgmt MAC Address:   00:A0:98:A4:F3:AF
                Ethernet Link:      up, full duplex, auto-neg complete
                Using DHCP:         no
        IPv4 configuration:
                IP Address:         10.72.231.51
                Netmask:            255.255.254.0
                Gateway:            10.72.230.1
        IPv6 configuration:         Disabled
        [Service Processor cached network information determined at Thu Aug 11 06:04:23 GMT 2016]
        slot 0: Internal 10/100/1000 Ethernet Switch
                Firmware Version:   Version11 SB_XXII ETHSW RZL
                Wrench:             auto-1000t-fd-up
                Device Type:        88E6176
        slot 0: Gigabit Ethernet I210
                e0M MAC Address:    00:a0:98:a4:f3:ad (auto-1000t-fd-up)
                Device Type:        1533
                Firmware Version:   3.25-5.4 0x800005CD
        slot 0: 10 Gigabit Ethernet Controller IX5-SFP+
                e0a MAC Address:    00:a0:98:a4:f3:9d (auto-10g_sr-fd-up)
                e0b MAC Address:    00:a0:98:a4:f3:9e (auto-10g_sr-fd-up)
                Device Type:        X550EM
                Firmware Version:   0.86-5.1 (20150807-0501)
        slot 0: 1/10 Gigabit Ethernet Controller IX4-T
                e0c MAC Address:    00:a0:98:a4:f3:9f (auto-10g_t-fd-up)
                e0d MAC Address:    00:a0:98:a4:f3:a0 (auto-10g_t-fd-up)
                Device Type:        X550
                Firmware Version:   1.0-5.1
        slot 0: 1G/10G Ethernet Controller CNA EP 8324
                (Multiple Dual-port, QLogic CNA 8324(8362) rev. 2)
                e0e MAC Address:    00:a0:98:a4:f3:a1 (auto-10g_sr-fd-up)
                e0f MAC Address:    00:a0:98:a4:f3:a2 (auto-unknown-down)
                e0g MAC Address:    00:a0:98:a4:f3:a3 (auto-unknown-down)
                e0h MAC Address:    00:a0:98:a4:f3:a4 (auto-unknown-down)
                Device Type:        EP8324N
```

```
        NIC Firmware rev:   5.4.56.0
slot 0: PLX DMA Engine 2 (PLX87d0)
        State:             Active
slot 0: Interconnect HBA: Generic OFED Provider
        Port Name:          ib0a
        GID:                fe80:0000:0000:0000:0000:0000:0000:0104
        Base LID:           0x104
        Active MTU:         8192
slot 0: NTB Interconnect i0 (PLX87b0)
        Max HW Data Rate:  PCIe Gen 3 x 8
        HW Data Rate:      PCIe Gen 3 x 8
        SW Data Rate:      PCIe Gen 3 x 8
        Logical Link:      Up
        Port State:        Enabled
slot 0: SAS Host Adapter 0a (PMC-Sierra PM8072 rev. C, SAS, <UP>)
        Firmware rev:       03.07.11.00
        Base WWN:           5:00a098:0038976:50
        Phy State:          [12] Enabled, 6.0 Gb/s
                            [13] Enabled, 6.0 Gb/s
                            [14] Enabled, 6.0 Gb/s
                            [15] Enabled, 6.0 Gb/s
        Mini-SAS HD Vendor:        Molex Inc.
        Mini-SAS HD Part Number:   112-00430+A0
        Mini-SAS HD Type:          Passive Copper (unequalized) 2m ID:00
        Mini-SAS HD Serial Number: 520830436
         ID     Vendor   Model            FW    Size
```

(Note - disk information removed to save space)

```
        Shelf 0: DS4486  Firmware rev. IOM6 A: 0190  IOM6 B: 0190
        Shelf 1: DS2246  Firmware rev. IOM6 A: 0190  IOM6 B: 0190
slot 0: SAS Host Adapter 0b (PMC-Sierra PM8072 rev. C, SAS, <UP>)
        Firmware rev:       03.07.11.00
        Base WWN:           5:00a098:0038976:54
        Phy State:          [8] Enabled, 6.0 Gb/s
                            [9] Enabled, 6.0 Gb/s
                            [10] Enabled, 6.0 Gb/s
                            [11] Enabled, 6.0 Gb/s
        Mini-SAS HD Vendor:        Molex Inc.
        Mini-SAS HD Part Number:   112-00430+A0
        Mini-SAS HD Type:          Passive Copper (unequalized) 2m ID:00
        Mini-SAS HD Serial Number: 520830403
         ID     Vendor   Model            FW    Size
```

(Note - disk information removed to save space)

```
        Shelf 0: DS4486  Firmware rev. IOM6 A: 0190  IOM6 B: 0190
        Shelf 1: DS2246  Firmware rev. IOM6 A: 0190  IOM6 B: 0190
slot 0: SAS Host Adapter 0c (PMC-Sierra PM8072 rev. C, SAS, <OFFLINE (hard)>)
        Firmware rev:       03.07.11.00
        Base WWN:           5:00a098:0038976:58
        Phy State:          [0] Disabled
                            [1] Disabled
                            [2] Disabled
                            [3] Disabled
        QSFP Vendor:        not available
        QSFP Part Number:   not available
        QSFP Type:          not available
        QSFP Serial Number: not available
slot 0: SAS Host Adapter 0d (PMC-Sierra PM8072 rev. C, SAS, <OFFLINE (hard)>)
        Firmware rev:       03.07.11.00
        Base WWN:           5:00a098:0038976:5c
        Phy State:          [4] Disabled
                            [5] Disabled
                            [6] Disabled
                            [7] Disabled
        QSFP Vendor:        not available
        QSFP Part Number:   not available
        QSFP Type:          not available
        QSFP Serial Number: not available
```

```
        slot 0: Fibre Channel Target Host Adapter 0e
                (QLogic CNA 8324 (8362) rev. 2, <LINK NOT CONNECTED>)
                Firmware rev:      8.5.1
                Flash rev:         5.0.2
                Host Port Addr:    000000
                FC Nodename:       50:0a:09:80:80:12:03:60 (500a098080120360)
                FC Portname:       50:0a:09:82:80:12:03:60 (500a098280120360)
                Connection:        No link
                Switch Port:       Unknown
                SFP Vendor Name:   AVAGO
                SFP Vendor P/N:    AFBR-709SMZ-NA2
                SFP Vendor Rev:    G4.1
                SFP Serial No.:    AD153030RG3
                SFP Connector:     LC
                SFP Capabilities:  10 Gbit/Sec
        slot 0: Fibre Channel Target Host Adapter 0f
                (QLogic CNA 8324 (8362) rev. 2, <LINK NOT CONNECTED>)
                Firmware rev:      8.5.1
                Flash rev:         5.0.2
                Host Port Addr:    000000
                FC Nodename:       50:0a:09:80:80:12:03:60 (500a098080120360)
                FC Portname:       50:0a:09:81:80:12:03:60 (500a098180120360)
                Connection:        No link
                Switch Port:       Unknown
        slot 0: Fibre Channel Target Host Adapter 0g
                (QLogic CNA 8324 (8362) rev. 2, <LINK NOT CONNECTED>)
                Firmware rev:      8.5.1
                Flash rev:         5.0.2
                Host Port Addr:    000000
                FC Nodename:       50:0a:09:80:80:12:03:60 (500a098080120360)
                FC Portname:       50:0a:09:84:80:12:03:60 (500a098480120360)
                Connection:        No link
                Switch Port:       Unknown
        slot 0: Fibre Channel Target Host Adapter 0h
                (QLogic CNA 8324 (8362) rev. 2, <LINK NOT CONNECTED>)
                Firmware rev:      8.5.1
                Flash rev:         5.0.2
                Host Port Addr:    000000
                FC Nodename:       50:0a:09:80:80:12:03:60 (500a098080120360)
                FC Portname:       50:0a:09:83:80:12:03:60 (500a098380120360)
                Connection:        No link
                Switch Port:       Unknown
        slot 0: Intel BDW SATA Controller u0a (0x50511000)
                boot0 Micron M600 MTFDDAT128MBF       MU05 122104MB  512B/sect
(16131225115A)
        slot 0: Intel USB EHCI Adapter u0b (0x50512000)
        slot 3: Flash Cache NVMe
                Serial Number:      S2UWNAAH400058
                Part Number:        110-00466
                Hardware Revision:  A0
                Firmware Version:   NA00
                Model Name:         X3311A
                Capacity:           1024 GB
                Vendor Name:        Samsung
                State:              ok
        slot 4: Flash Cache NVMe
                Serial Number:      S2UWNAAH400040
                Part Number:        110-00466
                Hardware Revision:  A0
                Firmware Version:   NA00
                Model Name:         X3311A
                Capacity:           1024 GB
                Vendor Name:        Samsung
                State:              ok


FAS8200-230-51-52::>
```

11 System Validation / Quality Assurance

We stress test our subassemblies of the system individually, rather than the system as a whole. Our strategy is to place the greatest emphasis on the earlier steps of the assembly process. Our ICT (In-Circuit Test) coverage is typically in the high 90% range, which is not easy to do when a controller has more than 10K components. We also incorporate advanced technologies to validate all the high speed buses at ICT. At functional test, we validate each functional block of the design. When the subassemblies come together at system test, we have very high confidence in quality of each, and focus on testing the interconnects of those subassemblies. We believe this provides better overall test coverage of the system.

Here's a brief summary of the subassembly and system testing:

PCM's

- All external I/O ports are thoroughly tested as well as all the internal buses. PCIe buses are placed under heavy stress test as these is the back-bones of the controller architecture.
- Entire physical memory is tested using 2 advanced algorithms.
- Service processor functionality is heavily exercised during PCM testing.
- PCM functional testing ranges from 50-90min depending on platform as I/O and memory have impact on test time.

System Chassis

- Data paths between all controllers (and all internal drives if applicable) heavily exercised.
- Fan control is exercised.
- Chassis functional testing ranges from 25-40min depending on model.

OSSG Storage Shelves

- Full functionality of the controller is tested.
- All data paths to drives are exercised for 4hrs. The health of each drive is carefully examined at the end of the 4hr drive I/O test.
- Drives are shipped integrated in the storage chassis; exceptions are DS4486, DS460C.

HSG Storage Systems

- Full functionality of the controller is tested.
- All data paths to drives are exercised.
- Drives are exercised for 1hr in test fixture. The health of each drive is carefully examined at the end of the drive I/O test.
- Drives are shipped integrated in the storage chassis; exceptions are Wembley and Trafford based systems.

System Level Test

- Interfaces between PCM's and chassis are tested.
- Interfaces between PCM and storage shelves are tested.
- Basic functionality of system as configured is tested.

Revision History

Revision	Date	Comment
1.0	September 2016	Initial release
1.1	September 2016	Update cluster interconnect support with 10GbE Base-T in table 6 Added support information about NVE in section 4
1.2	September 2016	Added supported ONTAP release details for 40GbE adapter in section 5. Removed UTA2 support with cluster interconnects in table 6
1.3	December 2016	Fixed SFP part number in table 9 Added UTA2 support back for cluster interconnects in table 6 Added command to set UTA2 port to FC-VI in section 5 Added NVMe Flash Cache base configuration in section 2 Added quotable shelf options in table 15 Added TPM and FlexGroups information to section 4
1.4	February 2017	Added support details for mixing GbE and 10GbE SFP+ on same UTA2 ASIC Added links to the NVMEM battery MSDS Corrected max Flash Pool size Added link to RAID-TEC demo video Added DS460C support Added more details about OKM not using TPM at this time. Added link to the Controller Upgrade Express Guide Added 32Gb FC autorange speeds of 8Gb and 16Gb Added design considerations for lithium-ion batteries to prevent potential fire issues
1.5	April 2017	Added question in section six about Energy Star rating Added command to monitor cluster interconnect traffic in section five Added appendix on system validation and quality assurance Added 10GbE BaseT autorange capabitlies in section five Updated answer for not supporting X2065 in section six Corrected NVMe 1TB Flash Cache part number in FRU table
1.6	May 2017	Added details about ADP support in section 6

Refer to the Interoperability Matrix Tool (IMT) on the NetApp Support site to validate that the exact product and feature versions described in this document are supported for your specific environment. The NetApp IMT defines the product components and versions that can be used to construct configurations that are supported by NetApp. Specific results depend on each customer's installation in accordance with published specifications.

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